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History Sheet

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Acronyms and Abbreviations

AEA	Atomic Energy Act of 1954
DOE	US Department of Energy
FRP	feed receipt process
HLP	HLW lag storage and feed blending process
HLW	high-level waste
LAW	low-activity waste
PT	pretreatment
PWD	plant wash and disposal
RDP	spent resin collection and dewatering process
WAC	Washington Administrative Code

1 Introduction

The Washington Administrative Code, WAC 173-303-640(4)(e), addresses tank systems containing dangerous waste. This code requires that secondary containment systems be designed to contain 100 % of the capacity of the largest tank within its boundary. Also included is the containment of the fire water discharge, where applicable, within the boundary of the secondary containment.

This report specifically addresses flooding scenarios to be contained within the pretreatment (PT) facility for Room P-0119, which contains the Spent Resin Collection and Dewatering Process System (RDP), and establishes the minimum requirements for secondary containment.

2 Applicable Documents

WAC 173-303, *Dangerous Waste Regulations*, Washington Administrative Code

3 Description

The PT facility receives low-activity waste (LAW) feed and high-level waste (HLW) feed from the Double-Shell Tank System. This mixed waste feed is pumped through double-walled underground transfer lines to the PT facility.

The purpose of the PT facility is to pretreat the waste received from the Double-Shell Tank System and to transfer it to the LAW and the HLW vitrification facilities. Within the LAW and HLW vitrification facilities, the waste is formed into glass logs suitable for long-term disposal.

Within the PT facility, the LAW feed is transferred to the waste feed receipt process (FRP) vessels (FRP-VSL-00002A/B/C/D), while the HLW feed is sent to the HLW feed receipt vessel (HLP-VSL-00022). These wastes are temporarily stored in the vessels before being pumped and treated by the PT processing equipment.

These vessels are located in black cells and are not accessible. The black cells are arranged in a "U" shape around a central hot cell in the PT facility, where major processing equipment is located.

The hot cell is remotely maintainable with the use of a crane system. Below the center of the hot cell are 2 adjacent rooms in the deep pit at the -45 ft elevation. This is the low point for the PT facility. Within these rooms are the plant wash and disposal (PWD) ultimate overflow vessel (PWD-VSL-00033) and the HLW effluent transfer vessel (PWD-VSL-00043).

The FRP vessels are the largest in the PT facility. The flood scenario at 0 ft elevation addressed a postulated failure of 1 FRP vessel and the movement of its fluid from a black cell to the hot cell, and then to the -45 ft elevation pit in *Flooding Volume for PT Facility* (24590-PTF-PER-M-02-005). The flooding scenario also addressed the fire water pit at the -19 ft elevation. The 0 ft elevation flooding document did not specifically address the flooding volume in Room P-0119, which is addressed in this document.

3.1 Room P-0119 Flooding Volume

Room P-0119 is located on the east side of the PT facility and houses the Spent Resin Dewatering Skid. The Spent Resin Dewatering Moisture Separator (RDP-VSL-00004) is the only vessel in the room. The secondary containment for Room P-0119 includes a low point sump (PWD-SUMP-00031) and a stainless steel liner. The floor of the room is sloped towards the sump. Room P-0119 does not have floor drains; in the event of flooding, the liquid is removed from the room through a steam ejector provided at the floor sump. The room has fire protection in the form of a sprinkler system.

The evaluation, which is provided in Appendix A, determines the flooding volume for Room P-0119 and determines the minimum height for the stainless steel liner. The flooding volume is determined from the volume of the largest vessel within the containment plus the accumulation of 20 minutes of firewater from sprinkler discharge.

The results of the evaluation indicate a flood volume of 178 cubic feet and a required minimum liner height that is 6-inches above the highest point of the grout or 13-inches referenced to the 0' 0'' concrete elevation.

Appendix A
Evaluation of Flooding Volume for Room P-0119

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Description

Room P-0119 is located on the east side of the PT facility and houses the Spent Resin Dewatering Skid. The Spent Resin Dewatering Moisture Separator (RDP-VSL-00004) is the only vessel in the room. The secondary containment for Room P-0119 includes a low point sump (PWD-SUMP-00031) and a stainless steel liner. The floor of the room is sloped towards the sump. Room P-0119 does not have floor drains; in the event of flooding, the liquid is removed from the room through a steam ejector provided at the floor sump. The room has fire protection in the form of a sprinkler system.

This evaluation will determine the flooding volume for Room P-0119 and determine the minimum height for the stainless steel liner.

Basis

- The dimensions of Room P-0119 are 20 ft long by 18 ft wide
- The dimensions of RDP-VSL-00004 are 24 inches diameter by 54 inches tall
- Sprinkler coverage for fire protection is 0.17 gpm per sq ft of room area
- The volume of PWD-SUMP-00031 is 73.5 gallons
- The maximum height of grout in Room P-0119 is 7 inches above the 0'-0" elevation concrete.

Method

The flooding volume is determined from the volume of the largest vessel within the containment plus the accumulation of 20 minutes of firewater from sprinkler discharge.

The minimum height for the liner is based on the flooding volume. Since the slope of the floor will direct water to the sump, credit is taken for the sump volume. The resulting net volume is divided by the available room area. The total room area is reduced by the footprint of the enclosed equipment to determine the available room area. The height of the liner will be determined from the height of the grout; for conservatism, no credit is taken for the volume created by the slope of the floor.

Determination of Flood Volume

From the dimensions of RDP-VSL-00004, the vessel volume contribution to flooding volume, Vv, is calculated from:

$$Vv = \pi/4 \times Dv^2 \times Hv$$

Where:

Dv = Vessel diameter, feet = 24 inches / 12 inch/ft = 2 ft

Hv = Vessel height, feet = 54 inches / 12 inch/ft = 4.5 ft

Then

$Vv = \pi/4 \times (2\ ft)^2 \times (4.5\ ft) = 14.14\ cu\ ft$

To determine the volume of firewater, the total room area, At, is determined from

$At = Lr \times Wr$

Where:

Lr = room length, ft = 20 ft

Wr = room widths, ft = 18 ft

At = 20 ft x 18 ft = 360 sq ft

Then

The volume of firewater, Vw, is given by:

Vw = (0.17 gpm/sq ft x 360 sq ft x 20 min) / 7.48 gal/cu ft

Vw = 163.6 cu ft

The flooding volume, Vflood, is the sum of these quantities:

Vflood = Vv + Vw = 14.14 cu ft + 163.6 cu ft = 177.7 cu ft

Rounding to the nearest integer gives

Vflood = 178 cu ft

Determination of Minimum Liner Height

The total room area is

At = 360 sq ft

The available area for containment excludes the area occupied by the equipment. For RDP-VSL-00004, the footprint area of the vessel, Av, is:

$Av = \pi/4 \times Dv^2 = \pi/4 \times (2\ ft)^2 = 3.14\ sq\ ft$

For the other equipment in the room, the footprint is estimated as follows:

Spent resin dewatering blower	RDP-BLWR-00001	2 sq ft
Spent resin dewatering container pump	RDP-BLWR-00001	2 sq ft
Supports for equipment and skid		2 sq ft
Area occupied by equipment		Ae = 6 sq ft

The available area, Aa, is determined from:

Aa = At - Av - Ae = 360 sq ft - 3.14 sq ft - 6 sq ft = 350.9 sq ft

The volume of the sump is:

Vsump = 73.5 gal / 7.48 gal/cu ft = 9.8 cu ft

As stated in the method section, for conservatism, the volume created within the sloped area of the floor is neglected.

The minimum liner height, Lmin, above the height of the grout, is

Lmin = (Vflood - Vsump) / Aa = (178 cu ft - 9.8 cu ft) / 350.9 sq ft

Lmin = 0.48 ft

Rounded up to the nearest inch,

Lmin = 6 inches above the grout

Referenced from the 0'-0" concrete elevation, the minimum liner height is 6 inches + 7 inches for a total of 13 inches.